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SPECIAL REPRESENTATIVES:

Ontario and Quebec: F. A. DALLYN

Toronto office — 21 King Street, E.

Montreal office — 1000 St. Antoine Street (Tel. UN. 6-5285).

Western Canada — Major J. W. B. GREEN, 503-12th Street "C" North, Lethbridge, Alberta.

Europe: S/L W. H. CORKILL, M. B. E., The Mead, West Dumps Lane, Ramsgate, Kent, England.

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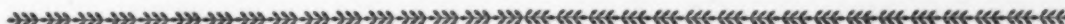
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Serious wash and rill erosion on an unprotected gentle slope.

Conservation Authorities in Southern Ontario

by A. H. RICHARDSON

Photographs by courtesy of the Conservation Branch,
Ontario Department of Planning and Development.

Introduction

CONSERVATION has long been a subject of concern to the people of Ontario. This concern had to do originally with the protection of forests because of their importance as a source of revenue to the province; but allied with this was the problem of wildlife management and the protection of source areas of rivers and streams. In Southern Ontario interest in conservation was indicated first by reforestation and woodlot management but more recently this has broadened out to include flood and pollution control, improved land use and provision for recreation facilities.

While the progress in these activities has been steady up to the present, most of the programs heretofore were initiated by government departments. Recently, however, there has been a growing conception of personal obligation, especially where land-use problems, farm ponds and small reforestation projects are concerned. On the other hand, control of flooding, summer flow and pollution, and large reforestation projects have come to be considered the responsibility of the community—the community, in this case, being the river valley.

With the advent of this new concept of personal and community responsibility in conservation, the Authorities movement was born, and the willingness of our people to undertake conservation in this way is indicated by the rapid progress made in establishing Authorities in the last six years. The Conservation Branch of the Department of Planning and Development was established in 1944 and was charged with organizing conservation work in southern Ontario on the basis of drainage basins, with all the municipalities contained therein as equal partners.

While those responsible for setting up the

new branch were satisfied that the watershed* should be regarded as a natural unit for such conservation work, the first activity of the branch was to organize conventions to inquire if the municipalities throughout the province were in agreement on this point. The first of these conventions, held at London, endorsed the proposal with enthusiasm and by resolution urged the Ontario Government to proceed with the conservation program on this basis as soon as possible. Subsequently similar conventions were held in eastern Ontario at Kingston and in central Ontario at Toronto. These also endorsed the same policy.

Accordingly, The Conservation Authorities Act was passed by the Legislature in the spring of 1946. In form this followed closely The Grand River Conservation Act, 1938, and The Thames River Control Act, 1943; but whereas the last two Acts named only urban municipalities as participants, The Conservation Authorities Act required that all municipalities in a watershed — cities, towns, villages and townships (not counties) — be included in the body corporate. This Act also broadened appreciably the field of conservation in which the Authority could participate and did not confine itself to flood control, which was paramount in the other two Acts.

The first step in establishing a Conservation Authority is undertaken by all the municipalities wholly or partly within a watershed. Two such municipalities must first by resolution petition the government to call a meeting for the purpose of ascertaining whether or not an Authority should be established. Two-thirds of the number of representatives which the municipalities are entitled to appoint (on a population basis) must be present to make

* "Watershed" is used as synonymous with "drainage area" or "catchment basin".

the meeting legal. If two-thirds of those present vote in favour of establishing an Authority a resolution is forwarded to the government. The Authority is then established by Order-in-Council and under the Act becomes a body corporate, including representatives from all the municipalities in the watershed.

Indicative of the enthusiasm of the municipalities across the province in their approach to conservation is the fact that fifteen Authorities have been organized: namely, the Ausable, Etobicoke, Ganaraska (1946); the South Nation, Moira, Upper Thames, Napanee (1947); the Grand, Don, Humber and Big Creek (1948), the Mimico Creek*, Catfish Creek and Saugeen (1949); and the Upper Holland and Middle Maitland (1951). The total membership of these includes 254 municipalities and the area of the province covered is 10,497 square miles.

While most of the Authorities were brought into being because of flooding within their areas, all were aware of the necessity of carrying out such supplementary measures as improved methods of land use, reforestation, proper woodlot management, prevention of pollution, investigation of underground water supplies, wildlife studies and recreation. But the Authorities were not equipped to carry out the extensive investigations that would indicate where such work should be done. Consequently the Conservation Branch of the Department of Planning and Development undertook to carry out the preliminary investigations as a service to the Authorities, to appraise, by means of surveys and reports, the conservation needs of each watershed, and to submit to the Authority in question a detailed report outlining the conservation measures that should be followed.

In order to carry out such surveys a few technical men were added to the Conservation Branch to head the different sections. With the assistance of students the necessary field work is done in the summer and reports are prepared by the technical staff during the winter. This method of using a small staff of technicians working together

and covering the whole field of conservation has made it possible to integrate the problems of a watershed and thereby present to the Authority concerned an interrelated program for their solution.

The survey work is grouped under five general headings: Land Use, Forestry, Hydraulics, Wildlife, and Recreation. The scope of the studies made in each of these subjects varies with the condition and needs of the area under investigation, with the result that in the completed report the findings recorded for each subject are related to the problem involved. In addition to the five conservation topics indicated above, a study covering the history of the area is incorporated. This serves as a backdrop to the whole conservation problem of the watershed and compels the reader to understand the abuses of the past and the need for a diversified program in the future.

The starting point for all surveys is aerial photography; in preparation for the work which has been done on each of the fourteen watersheds covered to date, the area was first specially photographed. Before the survey is commenced in the field all such contributing data as maps, old records, photographs, unpublished reports and other useful information are thoroughly explored and recorded. While the survey is in progress similar data are gathered locally and agricultural representatives, zone foresters, municipal clerks, other officials and private citizens are interviewed for additional material.

Land Use

The purpose of the land-use survey is threefold: to make an inventory of soil and water resources and land use, to appraise the capability of the land for agricultural use, and to prepare a developmental plan of land use to restore, improve and preserve soil and moisture resources. The approach to the subject is on a regional basis and the relations between soil, agriculture, forestry and water are carefully considered.

Detailed mapping of soil types, estimations of soil erosion, slope and susceptibility to erosion, and other factors affecting land

* Etobicoke and Mimico were joined as one.



The natural waterway through this grain field is outlined in white. It is kept permanently in grass to prevent erosion.

Aberdeen-Angus on an improved pasture near London, Ontario. Such pastures, specially prepared by seeding and fertilizing, carry many more cattle than would otherwise be possible.



use are observed in the field. Bodies of water, ditches and drainage conditions are included in the inventory. In these investigations aerial photographs are particularly useful because they reveal so much detail of soil and relief and because they serve as excellent base maps on which may be plotted data not shown on topographic sheets.

In addition to the natural features of the land, the present land use is mapped. For reconnaissance mapping (on a scale of one inch to the mile) cultivated, pastured, wooded and idle land are recognized.

Detailed surveys of sample areas are made for three purposes. First, making detailed observations trains field men to the best advantage. Second, a comparison with present land use of all the mappable features of soil, erosion and other limiting factors is the basis for assessing land-use capability. This assumes that the history of land use, as reflected in the present pattern, indicates the extent to which each soil has been found suitable for a particular use by the operators on the land. This rating of capability is, of course, checked against the previous findings of soil scientists with respect to each soil. Third, the results of a detailed study of a sample area are put forward as a plan to be used by local agencies for dem-

onstrating improved-land-use programs.

Proposed soil-conservation programs may or may not be practicable within the existing pattern of agriculture. For the most part, soil and water conservation practices adequate to protect a watershed can be instituted on individual farms without disturbing their economy. In some instances, however, soil conservation calls for large areas under grass. This might change farms considerably; for example, from a grain-producing to a grazing economy. Furthermore, grassland and woodland for watershed protection may be required over areas larger than individual farms. Artificial drainage, also, is a feature of land management which may involve a number of properties. Therefore, in order to obtain as full as possible a picture of land use, a geographic study is made of the types of farming carried on and upon this is based an attempt to classify farms in terms of their management of soil resources.

The results and conclusions of the survey are embodied in a map showing recommended land use expressed in terms of land use capability. These findings, based on the natural characteristics and present use of the land, take into account the economy of the region and the implications of any proposed change in land use.

An attractive and useful farm pond in the Nith Watershed. Many farmers are building such ponds for watering stock, for fire protection and for irrigation. If large enough they can be used for fishing, swimming and boating.





A pleasant rural setting in the Moira Watershed. Much of its beauty comes from the preservation of woodlots.



A desolate farm scene in the bouldery country also found in the Moira Watershed, where the land is too rocky and the topsoil too thin to make farming profitable. It is suitable land for reforestation.

Forestry

The forestry survey and report provide information (in so far as obtainable) regarding the condition and extent of the original forest, the sequence of wood-using industries, forest products and their yields, and conservation measures in progress on the watershed at the time of the survey, together with recommendations for future conservation measures.

Recommendations are based on the results of the field survey, the most intensive part of which is the examination of every piece of woodland two acres or more in size. Each of these woodland areas is mapped to show forest types, the approximate age and size of the stand, its condition, and whether it is fenced to exclude cattle. In addition, all swamps, bogs, sandy and rock areas, areas of willow scrub and lands which have been invaded by hawthorn and wild apple are examined and mapped. Areas surrounding springs which form the headwaters of streams and water-storage areas are included. Later these data are checked with the findings of the land-use survey and recommendations for acquisitions are made. If the area in question is large (over 100 acres) it is recommended that the local Authority

acquire it. If it constitutes part of a productive farm, but is important with respect to the regulation of stream flow, it is recommended that it be retained in forest or brought under reforestation by agreement.

Since the inauguration of conservation surveys in southern Ontario, the following areas have been indicated as suitable for reforestation and water-storage purposes.

Watershed	Total Area in Acres	Acreage of Land Recommended for Reforestation and Water Storage
Ausable.....	425,600	37,513
Don.....	90,240	3,600
Etobicoke-Mimico.....	71,680	992
Ganaraska.....	67,200	20,000
Nith (part of Grand)....	276,480	9,450
Humber.....	215,680	23,700
Moira (southern third) .	282,880	95,578
South Nation.....	967,680	198,076
Upper Thames.....	848,000	18,334
Total.....	3,245,440	407,243

In some watersheds, such as the Ganaraska and the South Nation, these areas are

Some of the land earmarked for reforestation in the upper reaches of the Ganaraska River. There are several thousand acres of this sandy soil which has been overgrazed and become badly eroded by wind and rain.





The limestone plain on the Napanee Watershed at a point where the stone shows above the surface in the appearance of a pavement.

in large blocks, 20,000 to 30,000 acres in extent, and the timber produced from them would be one of the most important economic features in the life of the community. In other watersheds the poor land occurs in smaller blocks of perhaps 1,000 acres interspersed with good agricultural

land; here the forests would play a smaller but none the less important part in the life of the people. In either case forests would provide necessary cover for soil erosion and water control and represent one of the foremost revenue-producing activities of the Conservation Authority.

The rock barrens near the southern edge of the Canadian Shield, near Kaladar, on No. 7 Highway.





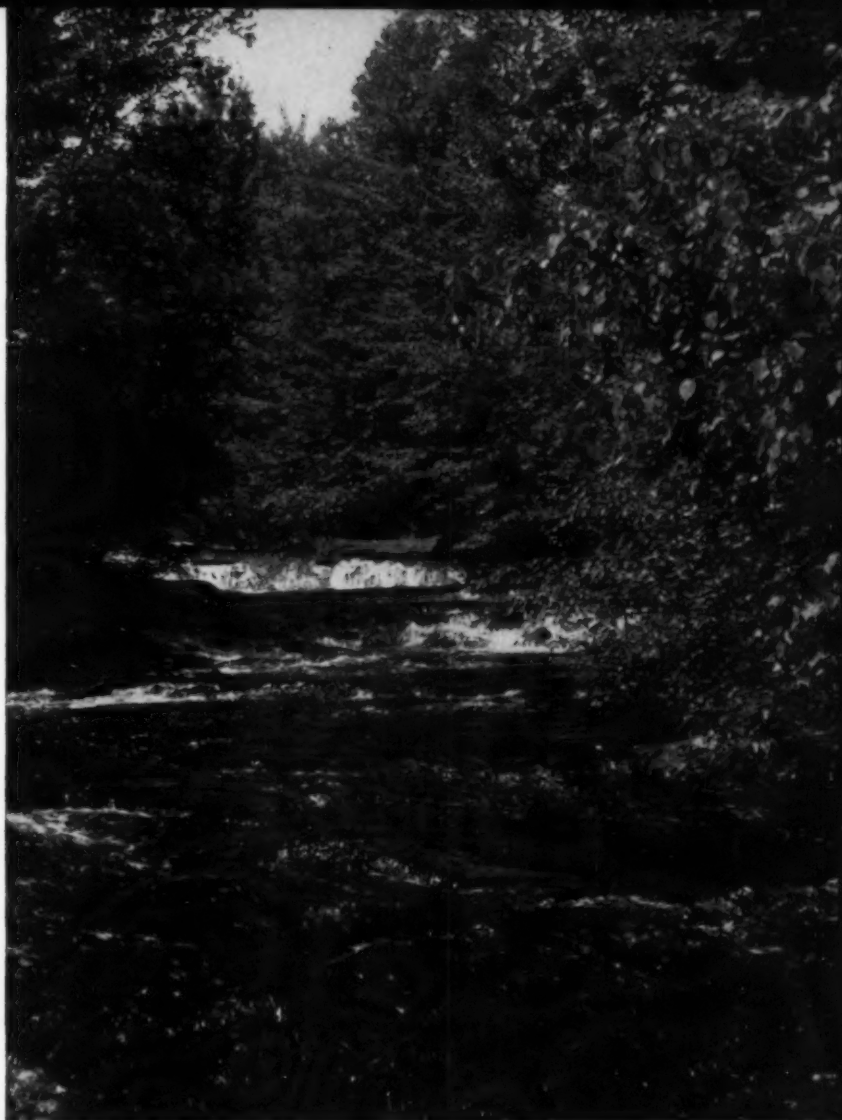
Cordwood cut from a well managed woodlot on the Moira Watershed. Dense reproduction indicates a continued supply of fuel-wood from this lot.

A mismanaged woodlot. All young growth is being browsed off, over-mature trees are left standing, and the soil is being trampled, to the serious detriment of the trees.



Woodland aids materially in run-off control, prevents stream bank erosion and keeps streams cool and habitable for game fish.

An example of the most harmful cutting practices. The cutting by-laws in many counties now prevent such clear-cutting of immature timber.





Main Street, Brampton, during the flood, March 16, 1948. Floods have long plagued the town, much of whose business section is built over the channel of the Etobicoke River.

Hydraulics

As the Department of Planning and Development is the only department of the government doing systematic hydraulic surveys, and as flood-control measures involve the most urgent problems to be solved by Authorities, these form a large

part of the work of the Conservation Branch.

Hydraulic studies begin in the office with a careful examination of all available data. Hydrometric and meteorological records kept over the years are checked and tabulated, and all available flood records are



The Shand Dam, and Lake Belwood, on the Grand River above Fergus. Opened in 1942, this was the first major flood control dam in Ontario.



The Brampton Flood Control Channel, completed this year, is shown carrying flood waters on March 11.

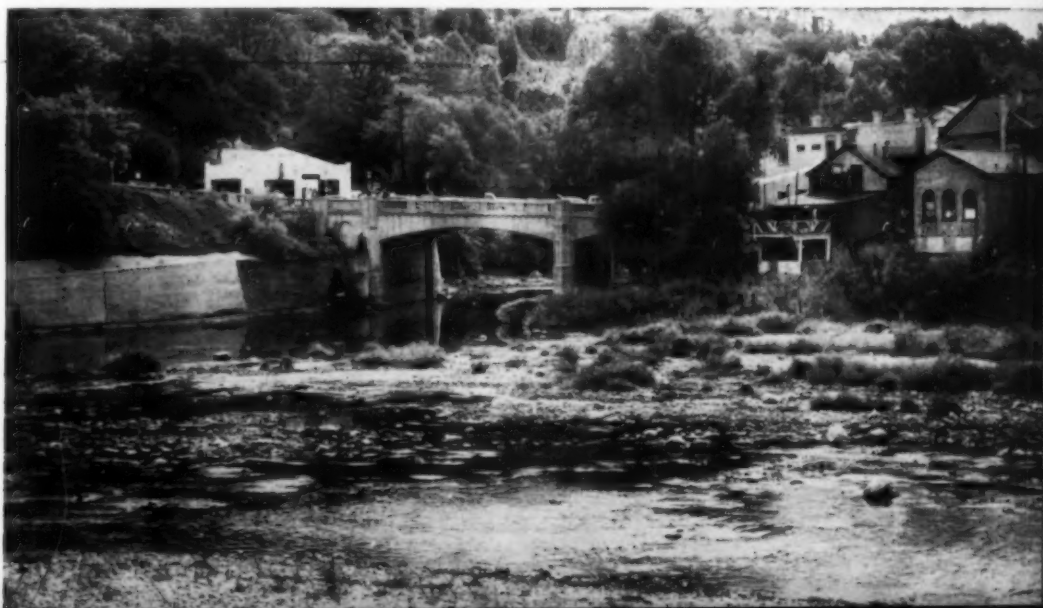
investigated and related with gauge records (if such exist) of the river in question, after which the number, size and location of reservoirs required to control floods on the watershed are determined.

Work in the field is done by the recognized survey methods best suited to the project under consideration. Storage reservoirs, dam site areas and channel improvements may be planned by the orthodox method of topographic ground surveys and plotting by hand. In open country, when conditions are suitable, the photogrammetric method is used; by this, with aerial photographs and ground control, plans are pre-

pared by stereo-projectors, either the Multiplex or the Wild machine being used.* When a choice between several reservoir sites is necessary, in order to determine their relative capacity and approximate cost, reconnaissance topographical surveys are made of all of the reservoirs under consideration, using Wallace Tiernan No. FA 176 altimeters and contour plans prepared by means of the stereo-comparagraph and sketchmaster. This method costs considerably less than the others and gives results accurate enough to make possible a selection of reservoirs — and in some cases sufficient for the final topographic plans.

* **PHOTOGRAMMETRIC METHOD.** A method of mapping by which special type projectors, operated by trained technicians, are used to transfer contour lines and other data from aerial photographs to a plan. Stereo-comparagraph and Sketchmaster are trade names for simplified desk models used for similar work but with less accuracy. Wallace Tiernan Altimeter is an aneroid barometer used for reading elevations to one foot.

The junction of the Nith and Grand Rivers at Paris, showing the rivers at low summer level.





A natural water-storage area provided by an elm swamp in the Catfish Creek Watershed.

There are many old mill dams in Ontario, now no longer serving their original purpose and falling into disrepair. Their preservation and restoration is urged as a conservation measure. This one is on the Eramosa River, a tributary of the Grand near Rockwood, Ontario.





A stretch of the Upper Ganaraska, properly protected for game fishing. It is free from pollution and the forest cover keeps the water temperature low enough to encourage trout.

Wildlife

Wildlife surveys include general inventories of all species of wildlife, both game and non-game; special emphasis is laid on vanishing or threatened species and detailed studies are made of the muskrat, meadow mouse and jack rabbit. Streams are classified

as to their suitability for particular species of fish. This work is based on exhaustive collections of "indicator species" of fish and river-bottom fauna and also on chemical measurements of pollution. On large watersheds such studies are made at many hundreds of stations on the rivers and tributaries.

Fieldmen on the Department of Planning and Development Wildlife Survey with a gar-pike taken in Lake Stoco, at Tweed. This fish preys on the young of the muskellunge.

The "Old" Ausable, above Port Franks. The main flow has been deflected into another channel and the abandoned watercourse provides an admirable natural wildlife refuge.





Lake Stoco, one of the countless Eastern Ontario lakes, provides muskellunge fishing and other resort facilities.

The results of pollution tests are also used in calculating the increased flow required to dilute sewage and industrial wastes.

Recreation

Recreation surveys now include estimates of the present and future population of the area served, descriptions of the present use

of all recreation facilities by local and outside residents, rating of all recreation facilities — publicly or privately owned, developed or undeveloped — and recommendations for new recreation facilities, for both the urban and rural population of the area.



Historical Research

A certain amount of historical matter is used in each report as a starting point for the study. This includes an account of the settlement of the area, available information on former floods and periods of low flow, and on former industries, such as mills and lumbering. Agriculture is reviewed as an introduction to the study of land use.

An attempt is made to get as true and localized a picture of past conditions as possible. To do this it is not sufficient merely to extract material from the published histories of the whole province. These books often contain general statements which prove to be not strictly true of each small area at exactly the same time; and they do not usually go into sufficient detail. The county histories and the papers of local historical societies comprise a more useful source. When these are more than fifty years old they are sometimes inaccurate in detail and misleading because the writers did not have access to all the contemporary material now available. Moreover, both kinds of publication deal with counties or townships whose boundaries do not coincide with those of the watersheds, so that it is necessary to select and assemble the required information from several different sources. To avoid being misled by the inaccuracies, misunderstandings or unconscious prejudices of these writers, an attempt is made to go beyond secondary sources to contemporary

books, newspapers, documents and maps and use these to check and correct the information obtained elsewhere.

In this way a certain amount of new material is usually produced and the subject is, in any case, approached from a different angle. Experience has shown that this fresh approach is of great interest to a large section of the public, and especially to the inhabitants of regions dealt with in the reports. It often serves to promote an interest in conservation among people who would otherwise remain indifferent or even hostile to it.

Use of the Reports

The results of these conservation surveys, together with the recommendations based upon them, are set down in the reports presented to the Authorities and intended to serve them as a blueprint. The carrying out of any scheme is not the work of the Conservation Branch of the Department of Planning and Development, which is not an operating department. Its active participation ceases when the planning is complete and the report is submitted, although it stands by to interpret the report and give advice and assistance in carrying out the plans recommended to the Authorities. The latter must assume responsibility for initiating the schemes which it considers most urgent; it must also make approaches to the government departments or other bodies from which it hopes to get assistance.

Extreme left:—An abandoned quarry, which has filled with spring water, has been developed into a fine civic swimming pool by the town of St. Marys.

Left:—The builders of this highway from Belleville to Madoc have successfully provided for motor traffic and retained the scenic beauty of a woodland drive.

Right:—A well preserved example of a log cabin built by the settlers in Ontario. This one is north of Belleville.



If, for example, a scheme undertaken by an Authority has to do with land use, it must seek assistance from the Department of Agriculture; if it involves a forestry or wildlife problem, then the Department of Lands and Forests is approached. In the case of flood control, however, as there is no department of the government doing hydraulic surveys except the Conservation Branch, whose staff is not large enough to carry through the engineering works of several Authorities, the Authority must engage a consulting engineer to do the final engineering and designing and to carry the work through the construction stage. Similarly, where an Authority undertakes a scheme which has to do with recreation, it must employ men specially trained in this work.

Before any scheme can be proceeded with, however, it must, as provided by The Conservation Authorities Act, be approved by three Ministers of the Crown; namely, the Ministers of Planning and Development, Lands and Forests, and Public Works.

As the work being done by Authorities is a new approach to the conservation problem, in that the responsibility of carry-

ing it out is left entirely in the hands of the Authority concerned, much directing and assistance have been necessary from the Conservation Branch. In the cases of one large Authority and two smaller ones combined, two employees of the Branch have been attached permanently to them as secretary-managers.

Projects and Plans

Flood control measures either completed or in progress are: Etobicoke-Mimico Authority — Long Branch flood control (\$79,178) and Brampton flood-control diversion (\$752,000); Thames Authority — Ingersoll flood-control channel (\$1,000,000); Ausable Authority — Port Franks flood control (\$120,000). For these works the Ontario Government is contributing 75 per cent of the cost, the benefiting municipalities within the respective Authorities paying the remaining 25 per cent.

For the Fanshawe Conservation Reservoir above the city of London, being constructed by the Thames Authority at a cost of \$4,635,252, and the Grand River Conservation Commission's Luther Marsh Dam, costing \$247,123, the Dominion Government is paying 37½ per cent, the Ontario Government 37½ per cent and the Authority 25 per cent.

The cost of the above projects totals \$6,833,553.

In addition to these projects which have been completed or are now under way, surveys and plans up to construction stage

A characteristic example of the homes built by the more well-to-do settlers in Ontario a hundred years ago. This "Canadian Regency" home was built by the grist and sawmill owner at Queensborough, on a tributary of the Moira, just before 1850.



have been completed for nineteen projects which would cost \$15,240,000 to construct and preliminary field surveys have been completed for twenty-eight projects which would cost \$31,590,000 to construct.

The second most important undertaking by Authorities is reforestation, and the most active Authority in this regard is the Ganaraska. In the Ganaraska survey*, which was made in 1942 and was the forerunner of the present river-valley surveys, over 20,000 acres were indicated as suitable only for reforestation. Shortly after the Ganaraska Authority was formed this work was selected as its most urgent need. An agreement was made between the Authority and the Minister of Lands and Forests to proceed with the reforestation of the area; this agreement was similar to the one which has been in operation for many years with the counties, except that in the case of the Ganaraska the government agreed to pay half the cost of the land. The Authority then decided to raise \$5,000 a year for a five-year period; as this period is now completed \$50,000 has been available for buying land. In 1951 the Ganaraska Authority decided to continue this work for another five-year period. Similar agreements for reforestation have been made with the Thames, Humber, Grand, Ausable and Moira Authorities.

In addition to the above activities, several of the Authorities — notably the Humber, Grand and Thames — with the co-operation of the Department of Agriculture and the Department of Lands and Forests, are carrying out other projects, such as farm planning, the building of farm ponds, and private reforestation. To provide assistance in establishing ponds six Authorities have issued a Farm Ponds bulletin with a total distribution of 14,000 copies.

While all important decisions must be made by the full Authority, and while, in the case of large Authorities, an Executive carries out the routine work, in most cases the most active unit is the advisory board. Under the Act provision is made for appointing advisory boards for any subject



The City Hall at Woodstock, dignified and well-preserved, stands in a civic square established over a hundred years ago, after Woodstock became the administrative centre for the Brock District.

which is considered necessary by the Authority. Such boards deal with the preliminary work, at least, in the following subjects: Flood Control, Public Relations and Education, Pollution, Farm Ponds and Little Dams, Reforestation, Land Purchases, etc. As the membership of these boards is not limited to the Authority, it opens a splendid opportunity for assistance from groups of all kinds in the area which are interested in conservation in all its branches; and while the final decisions must be made by the accredited members appointed by the municipalities who make up the Authority, nevertheless, through the operation of advisory boards, the work of conservation can become the personal concern of each individual living in the valley.

* See *Canadian Geographical Journal*, April, 1944.



An aerial view of Khartoum, capital of the Sudan. Governor-General's palace in foreground.

Progress in the Sudan

by JOHN HYSLOP

Camera Press photos, courtesy United Kingdom Information Office.

The Sudan is to have self-government before the end of this year. A Sudanese Cabinet will work out the form of the country's future rule—be it republic or monarchy, independent or incorporated into the Egyptian State, or a Dominion of the British Commonwealth.

Thus will culminate more than half a century of endeavour in which the aim has

always been to raise the Sudanese from almost complete illiteracy to the state of being able to take charge of their own affairs. During the whole of that time this million square miles of desert, rainland and swamp has been jointly ruled by Britain and Egypt, with a British Governor-General and a predominantly British Civil Service. Development has been swifter in the past five years than during any other period; and the speed of it has given rise to dangers in both the economic and political fields—of inflation on the one hand, and of internal disruption on the other.

The chief source of wealth in the Sudan is in the million-acre triangle of land known as the Gezira, whose apex is at the junction of the White and Blue Niles, just south of Khartoum, the capital.

The main airfield at Khartoum is an overnight stop for planes flying from Cairo to South or East Africa.

The Scheme that was Nationalized

Here since 1904 the tenant cultivators have grown cotton with varying degrees of success, developing from the two Niles an intricate system of irrigation canals. The scheme was first financed by London investors who agreed that the profit from the crop should be shared by the tenants. First rights to grow cotton under the scheme were given to the semi-nomadic people who could prove that they had already cultivated the land. Their share of the profit was fixed at forty per cent, the Government took forty per cent, and the investors the rest. Each group of partners had responsibilities:

The government—provision of land, maintenance and construction of the Sennar Dam and the main canalization.

The concession companies—construction and maintenance of subsidiary canals, levelling of land, provision of machinery, building ginning factories, collecting, storing and marketing the crop.

The tenants—the growing and picking of the crop under the supervision of the companies' inspectors. The tenants were given free of charge the grain (*dura*) which grows in rotation with the cotton.

The scheme worked well. Eighteen months ago, having given five years' notice of its intention, the Sudan Government nationalized the scheme. It bought for cash the solid assets of the concession companies, which went into voluntary liquidation, paying the shareholders from reserves and from the profit of the final crop.

Under nationalization, the tenants and the Government still receive their forty per cent of the profit but the twenty per cent which previously went to the investors now goes to the Gezira Board to be used on development, reserves and social welfare among the tenants. Until recently the Board was managed by Mr. Arthur Gaitskell (brother of Britain's former Chancellor of the Exchequer) who retired some months ago after nearly thirty years' service in the Gezira.

The first year of the new ownership coincided with a bumper crop and a record world demand for cotton, due to rearmament and stock-piling, and the result of this was that the 24,787 tenants received a record sum of £16,000,000, or about £650 each.

The Nile Valley. The western extremity of the Anglo-Egyptian Sudan is not shown in this map.
By permission of The American Geographical Society





Above:—Aerial view of the confluence of the Blue (foreground) and White (background) Niles. Khartoum stands where the two mighty rivers meet.

Below:—The Sennar Dam, central control point of the vast Gezira irrigation system between the White and Blue Niles.



When it is recalled that in 1939 a tenant was happy to receive £30 for his year's cotton crop, it will be seen that astonishing prosperity descended upon the Gezira.

The Boom — and After

The reaction of the Sudanese to a sudden access of wealth is, as in any other country, to reach out at once for a higher standard of living. Moreover, the Sudanese do not bank their money, take out insurance, buy houses on mortgage or invest in stocks and shares. Investment at low rates of interest does not attract them; insurance against old age is not necessary if they have sons, for these are their insurance. A son is obliged by local custom to support his father in old age, and the local *kadi* would enforce a father's claim in the rare event of a dispute about it. So the insurance premiums paid by the Sudanese are for the education of their sons—to fit them for the highly paid posts, and thus ensure a comfortable old age for father!

The first thing a Gezira tenant buys is leisure; that is to say he employs cheap labour to pick his cotton. Then he buys gold bangles for his womenfolk. He also buys food and drink, especially meat, eggs and milk, and, latterly, quite a lot of beer. Having plenty of money, he will pay any

Below:—The bridge over the White Nile that leads from Khartoum (in background) to Omdurman.



price for these goods, and the merchants who supply him will also pay whatever price is asked, for they know there is a rapid and ready sale. So prices rose throughout the country and, for a time, there was a threat of food shortages in the northern towns.

The Government was quickly aware of the danger, and made repeated efforts to persuade the tenants to save some of their money against less prosperous times. At last they convinced them that the boom would not last, that prices would go down, and that, with the Nile late in rising, the next crop would not be so heavy. The tenants were persuaded to permit the Government to withhold £2,800,000, or about seventeen per cent of their share, for one year. It was not as much as the Government would have liked, but it established a principle of which the tenants are already beginning to see the wisdom.

Five-year Development Plan

The Government share of the Gezira profit is being devoted to a five-year plan of development under which it will reserve £24,000,000, in addition to normal annual expenditure, for use as follows:

Agriculture, roads, telephones . . .	£10,500,000
Health and education	£4,000,000
Public utilities in the towns	£2,000,000
Administrative purposes	£2,000,000
Loans to municipal authorities for local development	£1,750,000

Below:—Goods are still carried thus to market in the South, where there are few transport routes.



The Southern Sudanese are either Christian or pagan, in contrast to their Moslem countrymen to the north. Church-going among the Christians is immensely popular (below) and there is usually an overflow congregation sitting on the grass outside (above) and joining in the singing.





In this large Khartoum market are displayed maize, millet, wheat and a vast variety of vegetables grown on the rich Gezira plain between the White and Blue Niles.

The remainder of the sum will be set aside to meet expected rising costs of all the schemes.

Under the heading of agriculture comes the expansion of the incessant search for crops alternative to cotton, and improvement of the cattle population by fighting disease and providing better water supplies in the grazing areas. Much money is being spent on mechanized crop production in the

central rain belt. The aim is to increase the yield per acre as well as the yield per cultivator, and the great need is for operators skilled in the use of mechanical ploughs, drills and harrows. Extensive training in the use of these machines is going on under the guidance of Canadian experts.

Great progress is being made by the veterinary department in the fight against rinderpest (cattle plague). New methods of

As there are few bridges, much native traffic crosses the Nile by ferry, the donkeys that carry local produce to market being frequent passengers.

Peanuts, grown in the South, are exported in quantity from the Sudan. Having reached Port Sudan by boat and rail, they are shipped to European markets.



Government-subsidized mission schools, employing Sudanese teachers, bring education to the children of the South. This girls' school is in the village of Yei.



immunization have improved the cattle population so much that in addition to 30,000 head of cattle exported annually on the hoof to Egypt there will be enough to supply a canning and by-products factory which has just gone into production at Kosti.

Roads have never been good in the Sudan, because there has never before been money for them. Now £2,000,000 will be spent on improving some of them, including the

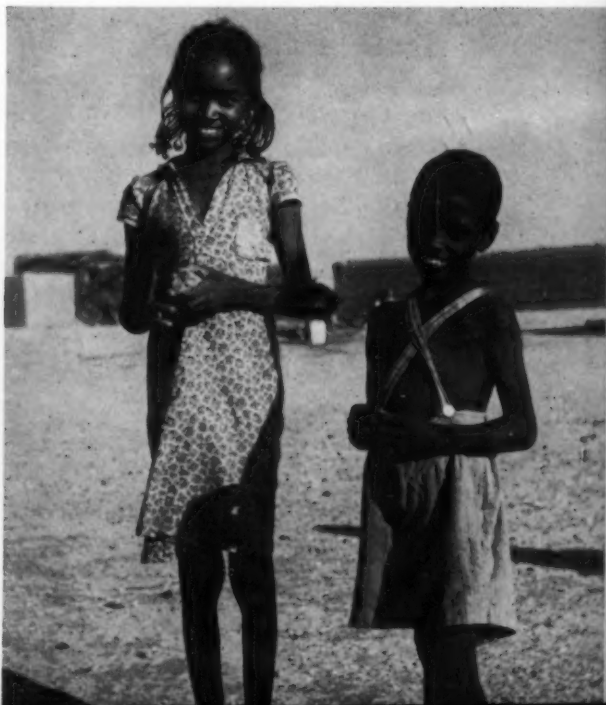
notorious El Obeid-Fasher road. There may also be a new road southwest from Khartoum to Fasher, by-passing El Obeid. This would not only give quicker access to Fasher but would draw population away from El Obeid, which, as the centre of the gum arabic industry, is growing too fast and outstripping its water resources.

New hospitals and schools, especially technical schools, are envisaged in the

Physical training exercises are vigorously carried on in front of the thatch-roofed village school by pupils in the Kakwa country of Southern Sudan.



Typical of the Arabic-speaking children in the urbanized sections of Northern Sudan are these two. Racially, they have no link with the Egyptians.



grants for health and education. Great stress is being placed on the need for technical education, for the ambition of most of the Northern Sudanese is to get a job as a government clerk; and there is a shortage of skilled craftsmen.

The Nile Water

All these schemes depend upon the Nile water, the control of which is vested in the terms of the Nile Waters Agreement of 1929. These allow the Sudan to take only two per cent of the flow at low Nile, but almost unrestricted supplies during the flood period. The Sudanese, through whose territory the river flows for nearly two thousand miles before it reaches the Egyptian frontier, are now fully awake to the value of the Nile water, and are demanding a bigger share of it. They can exist, precariously, without it, for the country has rain belts and grazing areas; but to expand and increase even further their standards of health and education they need more of the water and their growing demands are causing concern in Egypt. For the Egyptians cannot live without the Nile. For centuries their only food has come from land irrigated by its waters, and their whole economy has depended on it. The Egyptians therefore desire sovereignty over their southern neighbours, and all along the line they have opposed the British drive to create an independent Sudan because they fear that the Sudanese will take more of the water by building their own dams in their own territory.

That is why Egypt opposed the formation of the Northern Sudan Advisory Council in 1944, and the Legislative Assembly in 1948. The Executive Council (or Cabinet) of the Assembly has seven Sudanese and five British members and is the last stage before complete self-government. Before the end of the year the Cabinet will be entirely Sudanese.

As Envisaged by Kitchener

This achievement in the political field has been reached almost entirely through the development in education. Education and political wisdom have grown side by side,

just as envisaged by Lord Kitchener after he had rescued the country from the mad rule of the Khalifa in 1898. Sitting in his tent outside Khartoum after the battle of Omdurman had brought final victory to his forces, he pondered over the problem of a vast area rent and torn by internal strife and the unspeakable horrors of a dreadful regime. He saw that some form of internal security was of immediate importance, but almost equally urgent was the establishment of an educational system.

Having decided upon the creation of a university, he began it in a small way, as a school, which later became the Gordon Memorial College, and after that the University College of Khartoum. This college has produced from the sons and grandsons of the illiterate warriors of Omdurman, ministers, judges, lecturers, doctors, administrators, engineers. It has reached the last stage before becoming a full, independent university—reaching that stage just as, in the political field, the country has reached the last stage before complete self-government. So, as Kitchener foresaw, a nation has grown side by side with a university.

The officials who brought about these tremendous changes were the best that Britain could find. Assistant district commissioners starting their careers in the Sudan had at one time to be "Blues"—athletics or sports stars—and graduates of one of the senior universities—men of brains and character as well as brawn. They worked unremittingly, amid frustration, in tropical heat and in remote places, always spurred on by the promise and aim of the British Government—the creation of a nation.

First they made the country pay its way. Out of revenue they created free medical services (including hospitals and clinics), free education up to secondary standard, free training in mechanized farming. They introduced local government, trades unions and co-operative societies, encouraged the existing village councils and the discipline of debate. Their training, and the natural aptitude of the Sudanese have produced



Gordon College, built by funds from British public subscriptions and opened by Lord Kitchener in 1902, has now attained to University status.

members of the Assembly and Ministers who are keenly conscious of the dignity of office and the responsibilities of public service.

All these things happened in the progressive Northern Sudan; but in the South, which is peopled by an entirely different race, development was not so rapid, mainly because of the difficulties of communication. Even here, however, there have been notable advances.

It was seen some years ago that in the Zande area, on the southernmost border of the country, cotton could be grown because the soil was good and the rainfall heavy. However, the area is 1,600 miles from the nearest port, and it was not thought practicable to grow cotton for export. This remoteness also made the import of consumer goods costly and difficult. It was therefore decided to create some kind of self-contained economy. For seven years 1,500 Sudanese, guided by British technicians, have been building alongside the cotton fields, spinning and weaving mills, cotton

seed oil crushing plant, saw mills and a soap factory. Later there will be dye works so that in one small area all the processes between cotton seed and gaily coloured frock will be carried out.

As Self-government Approaches

The difference in racial characteristics between the Northern and Southern Sudanese is one of the causes of the second danger (referred to earlier) that the approach of self-government has brought to the country. The Moslems of the North regard the pagans of the South as slaves. The Southerners are afraid that their security will be endangered if the benevolent control of the British is removed before stable internal conditions have been created.

Again, the approach to self-government has widened the traditional split between the powerful Ansar and Khatmia Moslem sects. Leader of the former is Sir Sayed Abdel Rahman el Mahdi Pasha, posthumous son of the Mahdi whose followers killed



Sir Sayed Abdel Rahman el Mahdi Pasha, K.C.B., C.V.O., leader of the Ansar sect and the influential Umma party.

mia sect. But its main backing comes from Egypt, and its adherents follow a fanatical "Unity of the Nile Valley" line which is passionately anti-British and envisages union with Egypt of a self-governing Sudan.

As well as these leading parties there are half-a-dozen or so others, all more or less violently nationalistic in spirit. It will not be surprising, therefore, if there is internal political strife when British rule comes to an end. But observers who have watched the nursing of this new nation believe that these troubles will not be of long duration, but that the Sudanese will quickly see the wisdom of uniting in a great national effort rather than allowing too acrimonious party politics to retard their progress in the days of self-government and challenge that lie before them.

General Gordon in 1885. He is at the head of the most influential political party, Umma, which claims a million adherents and demands complete independence for the Sudan—to be attained constitutionally and followed by the setting up of a monarchy with Abdel Rahman as king.

Leader of the chief opposition group is Sir Sayed Ali Mirghani Pasha, whose National Front Party derives its strength mainly from the support of the foremost members of the Khatmia sect. This party demands complete national sovereignty, together with the kind of relationship between the Sudan and Egypt that India has with the British Crown.

The Ashigga party, a third powerful force, also receives support from the Khat-



Governor-General of the Sudan is Sir Robert G. Howe, K.C.M.G., seen here on the verandah of his palace in Khartoum.



National Museum of Canada

The Prairie Indian Tipi

by DOUGLAS LEECHMAN

TIPi is a Dakota Sioux word meaning "dwellings", the syllable *-pi* being the sign of the plural. They were used on the prairies where the scarcity of trees made the wigwam of the eastern Indians or the wooden house of the west coast tribes equally impossible. One great advantage of the tipi was its portability, for the cover could be rolled up into a bundle and the poles dragged along the ground to the new camp site.

Originally buffalo hides were used for the cover, but today canvas is preferred. Antelope and elk hides have also been used on occasion. Tipis were not always painted and, when they were, the designs were generally suggested to the owner in a dream. Today most tipis are painted because the white man expects it and they are often used on show occasions such as

the famous "Indian Days" at Banff.

Three or four poles were used as a foundation and others added till there were thirteen. The top of the tipi cover was tied to the top of the last pole, the one at the back, and hoisted into position by the women who put up the tipis. Two outside poles were used to adjust the wind-ears which drew the smoke out of the tipi.

The front was closed by a series of skewers and a hide covered the doorway. Often a cluster of deer hoofs made a tinkler or "door bell". The bottom of the tipi was held down by pegs or boulders and the fire was laid near the middle of the floor, towards the door. The beds were alongside the wall at the back and an inner wall of hide or canvas, often tastefully decorated, was tied to the poles inside and served to ventilate the tipi without allowing any draughts.



Mining Development in British Columbia

by JOHN F. WALKER

THIS is a story about mining in the backbone of Canada.

British Columbia lies within the Western Cordillera, the rugged mountainous backbone of the North American continent. Physiography has played such an important part in the development of the province and will continue to play such an important

part in its future that it should receive first consideration in any article attempting to describe the past, present or future of the province, its people and resources.

Physical Geography

The Interior Plains extending from the Arctic to the Gulf of Mexico end abruptly in

MINING DEVELOPMENT IN BRITISH COLUMBIA

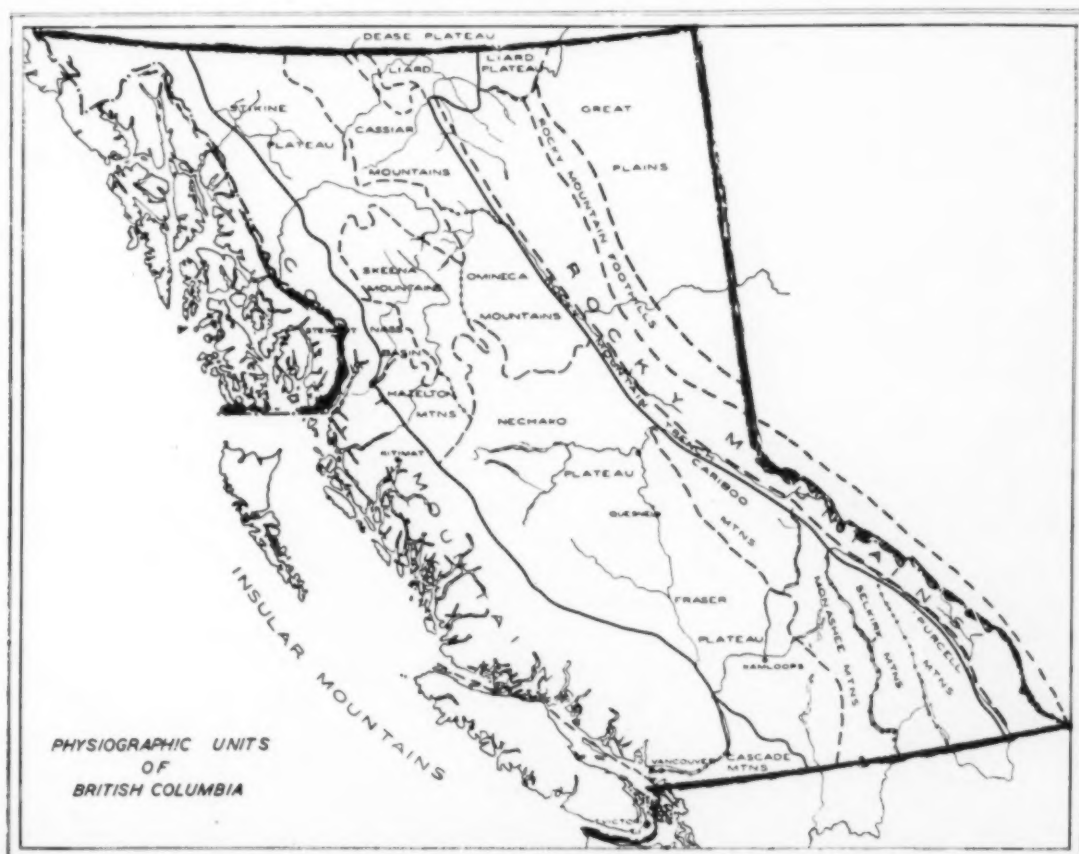
southern Canada against the eastern slopes of the Rocky Mountains. In Canada the Rocky Mountains form a rugged barrier fifty miles wide and nine hundred miles long on the east side of the Cordillera; they are separated from the mountain systems to the west by one of the most remarkable valleys in the world. This valley, the Rocky Mountain Trench, is occupied from south to north by the Kootenay, Columbia, Canoe, Fraser, Parsnip, Finlay and Kachika Rivers. Those from the Fraser south drain westerly to the Pacific; those from the Parsnip north drain easterly and northerly to the Arctic. To the west of the Rocky Mountain Trench are the Selkirk (including Purcell), Monashee (Columbia), Cariboo, Omineca and Cassiar mountain systems. The Cariboo and Omineca Mountains are separated by part of the Nechako Plateau, which abuts against the Rocky Mountains east of Prince George to cause the only partial interruption in the trough-like Rocky Mountain Trench throughout its entire length.

The Interior Plateaux country has been formed by the deepening of the river valleys

in an area of plains and low hills lying between these mountain systems and the Coast Mountains. The Interior Plateaux present a variety of land forms from comparatively level country to mountainous, but lacking the alpine character of the bordering mountain systems. The Interior Plateaux average sixty to one hundred and twenty-five miles in width. They extend from the Yukon border to the International Boundary, except where interrupted by the Skeena Mountains which extend from the Coast Mountains to the Omineca Mountains.

To the west of the Interior Plateaux lies the one hundred-and-fifty-mile wide belt of the Coast Mountains. Here is one of the most rugged mountain masses in the world. Here is a natural barrier that has played and will continue to play a major role in the development of British Columbia. Long fiords reach into the heart of the mountains. In the north great glaciers descend to the sea. Here are some of the last remnants of the Ice Age.

Beyond the mainland, and separated from it by the coastal trough, Vancouver



Island and the Queen Charlottes, in part mountainous, belong to a mountain system considered as distinct from the Coast Mountains.

The trend of the Cordillera is north-northwest and south-southeast. The intermontane valleys follow this trend or are north and south. There are no great valleys transverse to the entire Cordillera.

The chief passes through the Rocky Mountains are, from south to north, the Crowsnest, Kicking Horse, Yellowhead, Monkman, Pine and Peace. Westerly from the Crowsnest there is a circuitous route through the southern Selkirks from Cranbrook to Kootenay Lake and by way of Kootenay Lake to the Columbia River. Continuing westerly there is a difficult pass at Paulson and then the route is fairly easy across the southern end of the Monashee Mountains. West from the Kicking Horse is the difficult Rogers Pass through the Selkirk Mountains and the easier Eagle Pass through the Monashee Mountains. The Yellowhead and Monkman Passes give access to the Nechako Plateau where it abuts against the Rocky Mountains. Through the Coast Mountains from south to north are the Allison and Coquihalla Passes from Hope on the Fraser River, the Fraser, Cheakamus, Homathko, Bella Coola, Kitimat, Skeena, Nass, Stikine and Taku Rivers and the White Pass from Skagway in Alaska. The natural routes of travel follow the great valleys with the result that east-west routes are difficult and costly to develop.

Climatic

British Columbia lies within the belt of prevailing westerly winds which, coming from the Pacific, are mild and laden with moisture. These air-currents encountering the island mountains and the Coast Mountains are chilled and precipitate a great part of their moisture, producing a luxuriant forest-growth. Passing eastward the air-currents, deprived of most of their moisture, take up moisture over the eastern slopes of the Coast Mountains and the Interior Plateaux. This gives rise to the arid and

semi-arid conditions prevailing especially in the southern and central parts of the province. The easterly travelling air-currents encountering the high cold lands of the Selkirk and other mountain systems east of the Plateaux again precipitate moisture and again take it up as they pass eastward to the Rocky Mountains producing wet belts on the west side of the Selkirks and dry belts in parts of the Rocky Mountain Trench. Finally the air-currents precipitate on the western slopes of the Rocky Mountains and pass eastwards over the Interior Plains deprived of the greater part of their moisture.

Temperatures vary as widely as the precipitation, the mild climate of the coast becoming progressively colder inland or easterly and also northerly. The climate is not quite as simple as that outlined for it is complicated by cold air-currents that descend from the north to cause 'unusual' conditions. However, the picture is essentially correct.

Natural Resources

Throughout Canada there is a definite relationship between the bedrock geology and physiography, and between physiography and natural resources. This is true in British Columbia. The average elevation of the province is about 3,600 feet above sea level.

Agriculture, the basic industry of any country, is limited in the Canadian Cordillera to the bottoms of the bigger valleys and to the lower sections of the Interior Plateaux. Estimates of the area of arable land vary. Some of the latest figures, including the area east of the mountains, being 2.6 per cent and 3.6 per cent of the total area of the province. The population actually working on the land, therefore, will never be great.

It has been estimated that of the total area of the province, one-third is mountain tops and glaciers, one-third subalpine growth, muskeg or other waste land, and one-third productive of commercial timber. The great forests of big trees, the giants so



West end of Whitesail Lake on the eastern flank of the Coast Mountains, where the Aluminum Company of Canada is carrying out its great hydro-electric development.

B.C. Dept. of Mines

familiar in pictures of logging operations, are on Vancouver Island, the Queen Charlotte Islands and the coastal area south from Portland Canal. This does not mean there are no great stands of timber in the interior, for the greatest reported stand of pulp timber on the North American continent is to be found in the Interior Plateaux country north and south of the Canadian National Railways line to Prince Rupert. For many years the value of forest products has exceeded that of any other natural resource.

Fisheries have been an important resource since the earliest days of settlement, especially the salmon fishing industry. The Pacific salmon, however, is a peculiar creature that spawns only where it was spawned and then dies; and which does not feed after it encounters fresh water. It has the instinct and the strength, under normal conditions, to reach its spawning ground, but if too many unnatural obstacles are placed in its way and it does not reach its spawning ground, it will not spawn elsewhere before it dies. This is something that must be taken into consideration in

power development on the main streams.

Power, that is hydro-electric power, is rapidly becoming a major industry and may well become the chief basic industry in the province. There are in British Columbia some of the largest undeveloped hydro-electric powers within reach of year-round ports on this continent. Developed power is over one-million horsepower and potential power about another six million horsepower. Some day a decision may have to be reached, in fact the problem has already arisen, as to whether it will be fish or power—unless the fishery experts can devise ways and means of getting the temperamental salmon to its spawning ground.

And then there is recreation, tourism, or whatever one wishes to call the appeal of the great outdoors. There is everything in scenery from sagebrush desert to giant trees in primeval forests, canyons to ice-clad peaks, torrential streams and placid lakes and all kinds of game from pheasants to grizzlies, and trout to the great tyee salmon, year-round golf and almost year-round ski-ing.



Air view looking southwesterly over the Coast Mountains and Powell Lake towards the Strait of Georgia and distant Vancouver Island.

Bulkley valley and Rocher Deboule Mountain on the inner flank of the Coast Mountains near Hazelton.





Hedley, showing the Kelowna Exploration Company's mill and surface tram in right foreground and tailings from the Hedley Mascot mill in the valley above the village.

The northern end of the Cassiar Mountains near the Yukon border.

B.C. Government photographs





Early days in the Lardeau (in the West Kootenay district of the Selkirk Mountains). Left:—transporting 3,600 feet of aerial tram cable on pack-horses, in 1906, a tricky job requiring expert packing and handling of the train of 31 horses. Right:—upper terminal of an aerial tram.

E. T. Tucker (left) and Truman



Barkerville — a relic of the early days of placer mining.

Mining

This is not a story about all the natural resources of British Columbia. It is one about mining and the part it has played in developing the province. Over a hundred years ago fur traders entered what is now British Columbia from the Interior Plains by the Athabasca, Yellowhead and Peace Passes and from the coast by way of the Columbia River and its tributaries the Okanagan and Kootenay. It was not until the Forty-ninth Parallel was established as the International Boundary and the Hud-



One of the early mills in the Sheep Creek Camp, about 1909.

B.C. Dept. of Mines

The old arrastre at the Lorne Mine, now the Bralorne. The arrastre was a primitive mill consisting of a circular bed or trough made of stone round which a boulder was dragged. The boulder was generally attached by a chain to a long timber pivoted at the centre of the bed and a mule or horse was the motive power. In this case an overshot water wheel provided the power.





A view of the Granby Consolidated Mining, Smelting and Power Company's mill at Allenby, near Princeton, on the western edge of the southern interior dry belt.

B.C. Government

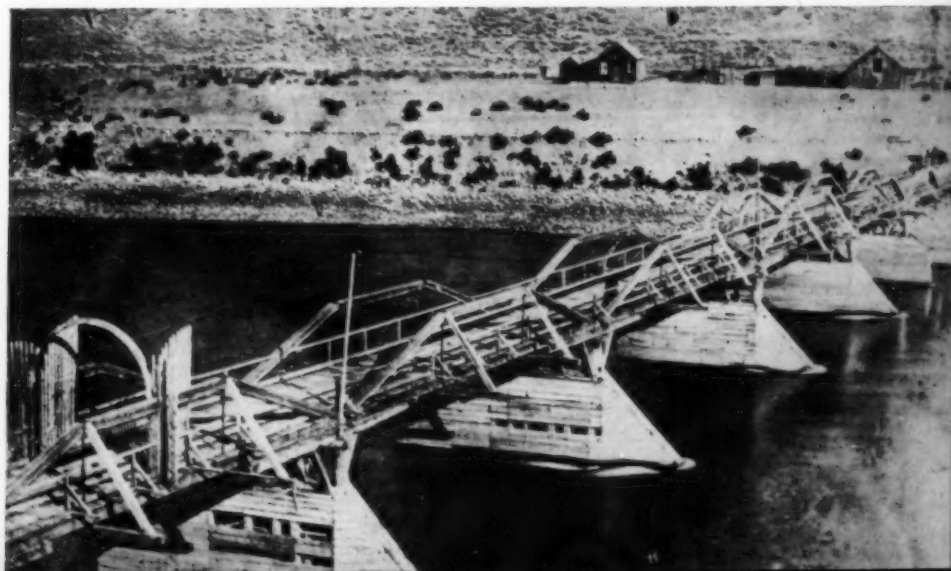
son's Bay Company moved its headquarters from Fort Vancouver on the Columbia River to Fort Victoria at the south end of Vancouver Island that any real attempt was made to establish a route into the interior through the formidable Coast Mountains north of latitude 49°.

Gold

It was not until the discovery of placer

gold near the junction of the Fraser and the Thompson in 1857, resulting in a stampede of miners from California in 1858, that good trails from the coast to the interior were constructed and pushed to completion. The great stampede to the rich placer diggings in California ten years earlier was over and the miners were looking for new fields. About twenty thousand people came in the first great rush. They had to be transported,

The original Spence's Bridge across the Thompson River, about 25 miles from Lytton on the Cariboo Road, built by Thomas Spence in 1864.





Prospectors panning the concentrates from sluice boxes behind them. Removable cross riffles are placed in the bottom of the lower boxes. Water is turned from the stream into the boxes and gravel shovelled into them. The gold is caught in the riffles and the gravel carried through by the current of water. When the riffles are moved the concentrate of heavy sand and gold is panned and separated.



Two monitors washing down the gravel bank, packed and to soften the bank a ditch was cut from it to the bank edge so that water could be turned where the monitors worked. The pressure was according to the head of water and the position of the pipe and nozzle opening of the monitor.

fed and clothed, and this was no small task in a new country where there were only about seven hundred white people and transportation consisted of Indian and traders' trails.

The first trail to be built was from the head of Harrison Lake by way of Lillooet River and Lake, Anderson and Seton Lakes to Lillooet in 1858.

In 1859 gold was discovered on Quesnel and Horsefly Rivers in the Cariboo. In 1861 rich strikes were made on Williams Creek near Barkerville and on Antler Creek.

Miners travelling overland from the United States found gold on Rock Creek in the southern interior in 1860.

The Lillooet trail was widened to a wagon road by 1861. Transportation beyond the end of road was by pack-trains of mules and horses. Each animal carried about 250 pounds of all kinds of supplies to the new diggings. One enterprising packer tried camels which could carry about a thousand pounds, but camels' feet were not designed by nature for rock and mud and their stench stampeded the mule trains. Suits for damages were brought against the owner and he turned his camels loose,

one of them surviving until about 1905.

In 1861 Governor Douglas ordered construction of a wagon road through the canyons of the Fraser River from Yale, head of navigation on the river. This road was completed in 1865, including a suspension bridge at Alexandra Crossing and a truss bridge built by Spence at a place now known as Spence's Bridge. Part of the road was built by the Royal Engineers, part by contractors, and it was an outstanding achievement. Heavy freight was handled by bull teams and passengers travelled by stage coach into the heart of the Cariboo.

Gold was discovered on Wild Horse Creek in East Kootenay in the southeast corner of the Province in 1863 and two years later on French Creek on the west side of the Big Bend of the Columbia, north of Revelstoke. In 1865 the Dewdney trail was completed across the southern part of the province to East Kootenay to take law and order to the placer gold diggings on Wild Horse Creek.

The placer miner roamed far and wide over the province reaching the Omineca in 1869 and the Cassiar district in 1873.

With the miners came traders, hotel keepers, teamsters, farmers and all the



the gravel bank. In this pit gravel was well compacted a ditch was dug behind the lip with channels that water could run continuously over the face. The pressure from the monitors is varied and the ratio reduction between conveying of the monitors.



This picture shows a dragline dredge operation with a caterpillar-mounted dragline and floating washing plant. Gold-bearing gravels are screened and the finer material passed over shaking tables and riffles where the gold and heavy sands are caught. The gravels are removed by the stacker and piled as shown to the right.

B.C. Dept. of Mines photographs

motley crowd accompanying a major stampede. It was the miner who wrested the country from the fur trader and opened it for settlement.

Interest in the placer gold fields of British Columbia played no small part in bringing the colony into Confederation and guaranteeing the construction of a railway to connect it with Eastern Canada. Some say that the chief object in building the Canadian

Pacific Railway was to establish an Empire route from the United Kingdom to the Orient, but the fact remains that the difficult Kicking Horse and Rogers Passes were chosen in preference to the better Yellowhead Pass because they were nearer to the International Boundary and the railway would be better able to serve the southernmost part of the province and meet competition from south of the boundary.



Base Metals

The completion of the Canadian Pacific Railway in 1885 created interest in base metal mining in the southern part of the province. The lode prospector and miner had followed the railway builders in the seventies in the United States and they now turned their attention to British Columbia. Lode deposits, both gold and base metal, had been discovered following the gold rush but had not been developed for lack of adequate transportation. It was not long after the building of the railway before the Slocan, Rossland and Boundary camps were booming. Thus mining development created a railway boom in the Kootenays and twenty-seven companies were incorporated for the purpose of constructing railway lines through this area prior to 1899. Most of them never materialized, but the Canadian Pacific Railway pushed its Crowsnest Pass branch through the Kootenays still closer to the border than the main line to shut out the competition of northern branch lines from the United States.

The discovery of rich placer gold in the Klondike in 1897 and the great stampede of 1898 attracted attention to the whole British Columbia coast and there was much prospecting along it and also on the inner side of the Coast Mountains, notably in the Bridge River area in the south and the Atlin area in the north.

Just after the turn of the century surveys for and construction of the Grand Trunk Pacific Railway to Prince Rupert resulted in a prospecting and mining boom in the Coast Mountains adjacent to the railway.

The railways and mining camps were connected by local roads and so we have, through mining development, the start of the framework of our present highway system.

Smelting

Small smelters were built in 1889 and 1890 at Vancouver, and at Revelstoke, Golden and Woodbury Creek in the Kootenays. Construction of these smelters was premature and they are now forgotten except

by a few old-timers. Smelters were built next at Trail and Nelson and successfully operated. The one at Trail, acquired by the Consolidated Mining and Smelting Company of Canada Limited in 1906, has grown through the years until it is one of the world's great non-ferrous metallurgical works.

Other smelters were built and operated in the Kootenays at Marysville and Pilot Bay and in the Boundary country at Grand Forks, Boundary Falls and Greenwood. In the coastal area smelters were built at Ladysmith and Crofton on Vancouver Island, at Vananda on Texada Island and Anyox on the northern coast.

Most of the ores from the base-metal mines operating in the nineties and early years of the century were direct smelting or self-fluxing and that accounts for the large number of smelters in the early days of mining.

Fifty years of advancement in the concentration of ores has changed the picture and today, with the exception of a few small high-grade operations, the mines are equipped with concentrators and the concentrates are shipped to Trail and foreign smelters.

Coal

There are fashions in minerals and metals as well as in other things and they are largely determined by world conditions. Coal-mining could have been mentioned earlier in this article as coal was discovered on Vancouver Island in 1835, but like the discovery of lode gold in the Queen Charlotte Islands in 1850 it did not affect the development of the country as did the later discovery of placer gold.

The export of coal to San Francisco, which started in 1853, grew in importance until about three-quarters of a million tons or 75 per cent of the output from Vancouver Island mines went to the United States. Discovery and development of oil and natural gas in California about the beginning of this century displaced coal and shipments declined to less than 100,000 tons in 1926 and practically stopped a little later.

Thus, coal and placer gold were the chief



The great smelter of the Consolidated Mining and Smelting Company of Canada Limited at Trail.
B.C. Travel Bureau

products of British Columbia mines until the middle nineties.

Other Metallic Minerals

Silver and lead production, which started in the late eighties, became important by the late nineties. It soon gave place to lode gold and copper production from the Rossland and Boundary camps. Copper in 1916 was the first mineral to have a value of over ten million dollars in one year. It held first place until 1924 when it was exceeded in value by lead until 1928, then won back first place for two years and finally lost to lead until 1937. Lode gold production assumed first place in 1938 and held it until 1942. Since then lead and zinc have vied for first place, with zinc in 1951 exceeding sixty million dollars in value, which is a record for any mineral in any one year in the history of mining in the province.

Not only have changing fashions in minerals affected prospecting, development and production, but so have improvements in metallurgical processes. In the flourishing days of the Slocan, zinc was a nuisance and not wanted. There was no zinc smelter in the country, thus high-grade silver-lead ores

were mined and the zinc was put over the dump or left in the ground. Today with high metal prices, efficient methods of concentration, and a demand for zinc, many of the old Slocan mines have been re-opened and the unwanted zinc mineralization of the earlier years is now ore. This is also the case in other parts of the province. It is somewhat different with copper because in the past it sold at as high prices as now but wages and supplies were much lower than they are today.

In 1937 a Geological Survey of Canada party working in the Fort St. James area discovered mercury at Pinchi Lake. During the war this property was brought into production and over four million pounds of mercury produced. The deposit is on the Pinchi fault which has been traced for over 120 miles and mercury deposits have been found at intervals along it. The mine was closed in 1944 when war contracts were cancelled. Here is an important mercury belt that some day will come into its own.

During the war two tungsten properties were developed and likewise shut down when tungsten contracts were cancelled. These properties are again in production



A steam shovel working in the gypsum quarry at Falkland in the southern interior.

B.C. Travel Bureau

and one of them is of major importance. The history of this property, the Emerald, is interesting as it illustrates the ups and downs in the history of a mine due to changing demands and prices for metal and greater geological knowledge and improved prospecting methods. Among the first prospectors in the Salmo area south of Nelson were men from Rossland looking for gold-copper ores and they discovered an iron capping on a hill they named Iron Mountain. Some small workings were driven on the iron capping but the prospectors found neither gold nor copper for which they were looking. Later high-grade lead-zinc ore was discovered nearby and was mined in a small way from about 1907 to 1925. During the last war the company's engineer was prospecting the property for molybdenum and samples were sent to the Department of Mines in Victoria for analyses. Routine examination under the ultraviolet light showed them to contain scheelite, an ore of tungsten. This led to intensive prospecting of the property for tungsten and the old iron capping discovered by the first pros-

pectors was found to contain scheelite. The property was acquired and developed by the Canadian Government. It was sold after the war and operated for a while as a tungsten property. During this period the new owners explored zinc showings on part of the property and developed a large tonnage of low-grade zinc ore. The tungsten mill was renovated and is now milling about 800 tons of zinc ore per day. Last year the Government of Canada again became interested in tungsten and a new 250-ton mill was built. This mill has been enlarged to treat 500 tons of tungsten ore per day. The development of low-grade zinc ore in this property is probably partly responsible for developing low-grade zinc ore in an adjacent property which will be producing late this year at 1,000 tons per day. These properties are on each side of Sheep Creek, an active gold camp in the thirties but where gold mining is now dormant.

Transportation

Transportation has often been the major factor in the development of a mining area.



At top:—Removing the overburden for coal strip-mining in the Crowsnest Pass area.

Above:—Britannia Mill (copper and zinc concentrates, iron pyrites) on Howe Sound.

Right:—Asbestos (vein above prospector's hand and loose in foreground) in McDame Creek area near the Yukon.

Below:—Plant and quarry of the B.C. Cement Company at Bamberton on Saanich Arm, near Victoria.

B.C. Dept. of Mines and Travel Bureau photos





Left:—Part of the Pinchi Lake mercury plant on the northern Nechako plateau.

Right:—Pinchi Lake and part of the Consolidated Mining and Smelting Company of Canada camp at the Pinchi mercury mine, the largest mercury producer in the Commonwealth during the war.

B.C. Dept. of Mines photographs



The Bridge River lode gold camp was discovered in the late nineties but was difficult to approach. The nearest point of access was Ashcroft on the Canadian Pacific Railway, 63 miles by wagon-road from Ashcroft to Seton Lake, then 12 miles by water transportation on the lake and another 50 miles by wagon-road to the camp. It was a tough proposition to make fifty-dollar gold ore pay under such conditions. Construction of the Pacific Great Eastern Railway eliminated the haul from Ashcroft to Seton Lake and the boat haul on the lake. This made it possible to develop mines in the Bridge River and work was done in the twenties. Then came the depression, followed by the increase in the price of gold and Bralorne and Pioneer became profitable producers.

During the depression years a road was built from Fort St. James 125 miles north into the Omineca mountains to open up a promising mineral area. This was a joint federal-provincial relief project. The area adjacent to the road was geologically

mapped by the Geological Survey of Canada. The great Pinchi Lake mercury deposit is 15 miles from this road. Much prospecting has been done since geologists mapped the area in the vicinity of the road and in the vicinity of the 80-mile winter road extending north from it to Aiken Lake. Prospects of sufficient interest have been found to warrant the bridging of the Omineca and Osilinka Rivers, and this with conversion of part of the winter road to a truck road this season, will help development.

Earlier it was noted that placer miners reached the Cassiar in 1873. Mining camps, like Laketon, flourished in the Dease Lake area and disappeared. A few placer miners stayed and made a living placer-mining and trapping. Lode gold deposits were discovered and in the thirties an attempt was made to develop them but transportation into the district was extremely difficult and costly. It was by river boat from Wrangell, Alaska, up the Stikine during the short summer season, thence 70 miles of poor road

MINING DEVELOPMENT IN BRITISH COLUMBIA

to Dease Lake, 90 miles by small boat down the lake and river and finally ten or more miles by trail to the properties. The alternative was air transportation from Whitehorse or Carcross and that was also difficult and costly. The Alaska Highway was built and dredging possibilities on the Dease attracted United States capital. With government aid a road was built south from the highway to McDame Creek, a tributary of the Dease River. Dredging was carried on for two seasons. In 1950 a prospector discovered a large outcrop of serpentine containing high-grade spinning-fibre asbestos. The road is being improved for heavy haulage and it is expected that a mineral not heretofore mined in British Columbia will be produced this year. Zinc and copper prospects in this area are receiving attention. Though far from markets the building of 90 miles of road south from the Alaska Highway has created interest in an old-new mineral area. Mineral is the only natural resource occurring in sufficiently concentrated

form, that can be further concentrated, to stand transportation costs from such an isolated area. But a mining camp means that lumbering, market-gardening and services of all kinds will be established nearby. Again the frontier is being pushed back in another part of the province.

Modern Prospecting

It has been the man with a pack on his back looking for nature's concentrations of rich placer gold who blazed the first trails to be followed by others with pack-horse, wagon and railway. Now the topographer and geologist with aeroplane, helicopter and

The Pioneer gold mine in the valley of Bridge River, which enters the Fraser above Lillooet, as it was in 1935 and (inset) in the early days, about 1910.

B.C. Travel Bureau





Left:—Looking north across Whistler and Johannson Lakes in the northern Omineca Mountains.

Left, below:—The pack-horse still plays his part in the service of geologist, topographer and prospector. Here a pack-train crosses Beaton River at Mile 147 on the Alaska Highway.

B.C. Travel Bureau

Right:—Raw-hiding ore in the Lardeau in 1914. Sacks of ore, wrapped in a raw cow-hide with the hair on the outside, were hauled down snow trails as illustrated.

Below:—Northern part of the Rocky Mountain Trench, with Sifton Pass on the left between the north-flowing Kechika and the south-flowing Fox in the foreground. Rocky Mountains in background.

B.C. Dept. of Mines



pack-horse make topographic and geological maps and the prospector searches for mineral of any kind in geologically favourable areas. The scientific prospector goes still further and uses various prospecting aids in his search for mineral, not only in new and favourable areas but in the old mining camps. He uses geophysics to determine differences in resistivity and magnetism that may indicate ore, and geochemistry to determine the amount of mineral taken up by vegetation or carried in stream waters to lead him to mineral hidden beneath the soil. The diamond drill is used to test favourable structures.

Thus an area may be prospected time after time and new discoveries still made or old discoveries rediscovered in the light of changed conditions.

Geological Survey

When British Columbia joined Confederation, one of the agreements under the Terms of Union was that the Geological Survey of Canada should make a geological survey of the province. In the eighty years since joining Confederation the Geological Survey has maintained one or more parties in the field each year, the greatest number being thirteen in recent years. To date slightly less than one-third of the province has been geologically mapped, mostly on a scale of four miles to the inch and smaller.

Much remains to be done but sufficient mapping has been done to give a generalized picture of the geology and an idea of the minerals to be found in different parts of the province. In the northeast corner to the east of the Rocky Mountains are sedimentary formations, characteristic of those found in the foothills and Interior Plains areas. In British Columbia they are known to contain coal and natural gas and the discovery of petroleum in commercial quantity may be made any day. Its presence is known. Other deposits associated with rocks of this kind, such as salt, may be found.

The Rocky Mountains are built chiefly of sedimentary rocks older than those found in the plains except in the Crowsnest Pass

area where the younger coal measures are found. Gypsum and phosphatic limestone occur as bedded formations. Some metallic deposits are known such as the zinc-lead ores at Field and on the western flank of the southern part of the mountains.

To the west of the Rocky Mountains throughout all the other mountain systems and the Interior Plateaux is a great variety of sedimentary and volcanic rocks intruded by great masses of granite and related rocks. Throughout all of this area except, perhaps, where the older rocks are masked by fairly recent lava flows in the Interior Plateaux, any kind of mineral deposit may be found.

During the last ninety years most of the province has been prospected for placer gold and some parts have been intensively prospected for lode gold, copper, silver, lead and zinc, but great areas have not been prospected at all or prospected in a most cursory manner.

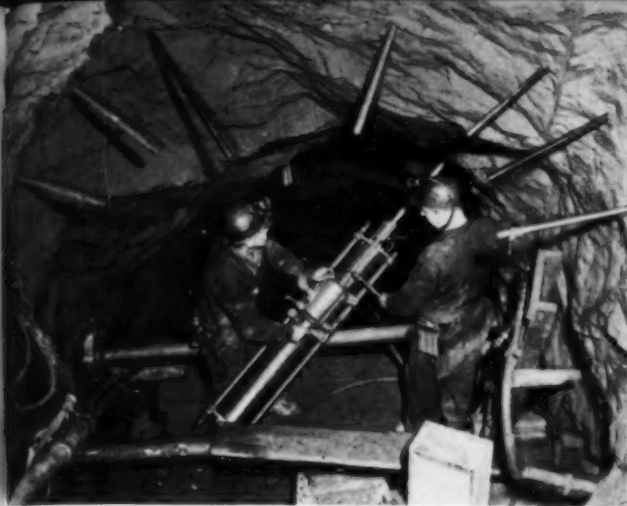
It is true that many of the easily accessible parts have been thoroughly gone over by the old-time prospector but it is also true that he did not thoroughly search large tracts of heavily wooded country. It is also true that he was looking for minerals in fashion and that while he may have noted other minerals, which had no market value at the time, he did not record the information. Discoveries can still be made in some of the oldest and most closely prospected sections of the province.

Canada's backbone is big and rugged and generations will come and go, new discoveries will be made and old discoveries will become mines but there will always be something to learn about the treasures nature has hidden so well in this entrancing country.

* * *

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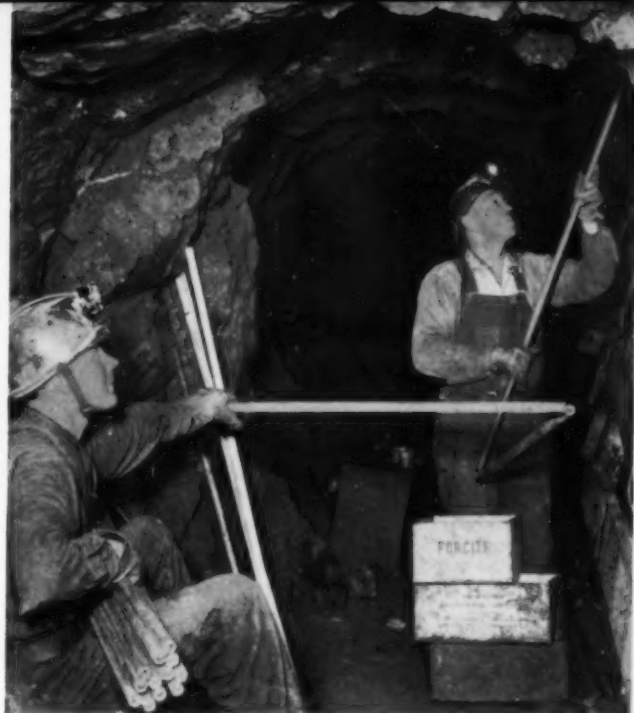
1.

**IN THE SULLIVAN MINE,
LEAD AND ZINC PRODUCER**

1. Diamond-drilling rings of holes for a blast.
2. Loading the holes shown in the first photograph.
3. Completing a primacord hook-up for a blast.
4. The result of the blast prepared in the previous pictures. Marks of the radial holes from the two levels can be seen on the face of the stope.
5. Barring down in a big stope. The barman removes loose rock to make the stope a safe working place.

5.

Consolidated Mining & Smelting Company of
Canada and B.C. Travel Bureau photos



2.



3.



4.

EDITOR'S NOTE-BOOK

A. H. Richardson is Chief Conservation Engineer of the Conservation Branch of the Ontario Department of Planning and Development. For many years he was in the Department of Lands and Forests of Ontario, in charge of reforestation and later specializing in conservation and rehabilitation. Mr. Richardson founded, and edited for ten years, the *Forestry Chronicle*, and he has been special lecturer in forestry at Ontario Agricultural College at Guelph.—John F. Walker, who was formerly on the staff of the Geological Survey of Canada, has, since 1937, been Deputy Minister of Mines in the British Columbia Government. Other appointments held by Dr. Walker include membership of the Board of Management of the B.C. Research Council, and membership of the National Committee on Research in the Geological Sciences.—John Hyslop is a British expert on the Sudan. As former editor of the *Sudan Star*, largest English-language daily newspaper in Khartoum, he was closely in touch with Sudanese affairs.

* * *

ERRATUM

Vol. XLV, No. 1, July 1952, p. 39: At the beginning of the third caption, for vase-line substitute petroleum jelly. ('Vaseline' is a registered trademark that was used erroneously.)

* * *

AMONGST THE NEW BOOKS

Geography in the Making

The American Geographical Society 1851-1951

by John Kirtland Wright

(American Geographical Society, New York, \$5.00)

This year the American Geographical Society of New York is celebrating its one-hundredth anniversary. To mark the occasion, Dr. Wright has written this record of the society's activities and achievements since its inception.

But the book is not a mere chronology for, in unfolding his story, the author has shown how the organization gradually overcame its early financial difficulties and factional strife to become one of the leading geographical societies of the modern world. This was largely due to the vision and public spirit of its governors and

staff and such an attitude enabled the Society gradually to take an increasing part in advising the Government of the United States — the role of its Director at the Paris Peace Conference in 1919 being perhaps the culmination of such activities. At the same time, the growth and prestige of the organization permitted it to undertake several ambitious research projects of which the Millionth Map of Hispanic America was the largest. The flexibility of the society to meet new needs and conditions, which developed as a result of these activities, is one of its outstanding characteristics and is indicated by the chapter on "The Face of the Earth as Seen from the Air" and the events of 1935 onwards. With such a record it is little wonder that the book occasionally lacks modesty. On one's one-hundredth birthday, a little self advertisement is perhaps to be expected.

The book is well illustrated with almost a hundred photographs, maps, and diagrams. It is a curious coincidence that the first of the photographs is of Isaiah Bowman, the Canadian-born Director of the Society from 1915 to 1935, while the last photograph includes G. H. T. Kimble who was a Canadian citizen when he became the Society's present Director. Of interest too are the references throughout the book to the part the Society played in research in Canada. Northern Canada has always received relative prominence in the Society's periodical *Geographical Review*, particularly in 1885-89 when so much exploration was taking place in the Arctic and the rest of the then Northwest Territories. The "explorer-ethnologists" Stefansson and Jenness were frequent contributors to the review as was Griffith Taylor, who, along with the geologist J. B. Tyrrell, was one of the Society's medalists. George Tatham is the only professional geographer who is still in Canada who is mentioned in the book.

In keeping with Dr. Wright's meticulous style, the book is thoroughly documented. Furthermore, it not only gives glimpses of the well-known geographers and allied scholars whose activities have been woven into those of the Society but it also portrays certain facets of the development of geography in the United States during the past century. Consequently it should have wide appeal as a reference work for all geographers.

NORMAN L. NICHOLSON

* * *

Conservation in Canada

by O. M. McConkey

(J.M. Dent and Sons (Canada) Limited, Toronto, \$3.50)

The conservation of natural resources is a subject which has been given increasing thought and attention in recent years as a result of careful appraisals of the relationship between the increasing world population and world food production. Consequently, Professor McConkey's book is a timely addition to the rather sparse Canadian literature on the subject.

The book is geographical in approach in that it includes chapters on the climate, natural vegetation and major soil zones of Canada as well as several

references to works by Canadian geographers, but as the author is an agriculturist, the bulk of the book is concerned with those practices which may help to prevent soil erosion by wind and water and soil depletion by overcropping and overgrazing. Grass waterways, contour cultivation, strip cropping, windbreaks and stubble-mulch farming are but a few of those discussed. But the problems of wise or intelligent use of forests, marshlands, wildlife, fish, and minerals are also dealt with and there are useful chapters on conservation projects in Canada and the relationships between conservation and industry, recreation and education. Indeed, no aspect of the "earth and water" from which "all wealth derives primarily" has been overlooked and the author has treated these subjects with a simplicity and conciseness of style which makes the book easy and pleasurable to read. No direct consideration, however, is given to the problems of the areas within which most Canadians live, that is, to the conservation problems of the towns and cities, although it is inferred throughout that Canada's most important resource is her people.

Occasionally, Dr. McConkey takes the opportunity to express some of his views on national policy towards resources. He regards it as "important and urgent", for example, that Canada process all raw materials on Canadian soil and that the natural resources of the country be developed with a much higher proportion of Canadian capital. Such discussions as these add to the thought-provoking nature of much of the book.

The almost seventy photographs are well selected and excellently reproduced and although the maps are familiar to most geographers, they enhance the value of this up-to-date view of *Conservation in Canada*.

NORMAN L. NICHOLSON

* * *

The Sultan of Morocco

by Rom Landau

(Ryerson, Toronto, \$2.00)

The author has devoted much of his life to the study of Islamic affairs and the Arab world and is therefore in an excellent position to write this factual and authoritative account of Sidi Mohammed V, the ruling Sultan of Morocco. It is, in a sense, an official publication since it was written with the whole-hearted consent of the Sultan, with the assistance of his personal friends, and after interviews between the author and his subject.

The outlook and chief interest are, naturally enough, political and the reader is enabled to learn a good deal about the long continued efforts that Sidi Mohammed V has made to free his country from French domination and to introduce a modern and efficient system of self-government. It is not exactly light reading and, though there are some references to Moroccan customs and culture, the reader will find the modern Sultan far removed indeed from the rulers of the glamorous days of Harun al Rashid.

DOUGLAS LEECHMAN

'Round New Brunswick Roads

by Lilian Maxwell

(Ryerson, Toronto, \$3.50)

For one making a tour of New Brunswick by car, this little volume might be worth tucking in the glove compartment to afford one some idea of what lay ahead and what was worth stopping to see, but for straightforward reading it is a bit indigestible, being so filled with facts (many of them trivial) as to become stodgy. The style is laboured and uninspired and the lack of a map, except for the quite inadequate end-papers, lessens its value to the tourist. An occasional solecism, such as "a specie of bird life", makes one wonder what the proofreader was thinking about. Some of the photographs are interesting.

DOUGLAS LEECHMAN

* * *

Natural Regions of the U.S.S.R.

by L. S. Berg

(Translated from the Russian by Olga Adler Titelbaum)

(Macmillan, Toronto, 1950, \$11.50)

Professor Lev Semenovich Berg, who died in 1950, was president of the All-Union Geographical Society of the U.S.S.R., and one of the most eminent Russian geographers. Because of the wide scope of his interests, his thorough knowledge of the Soviet Union, and his deep understanding of the essence of geographical landscape, he was well able to create a sound fundamental treatise on the natural regions of the U.S.S.R.

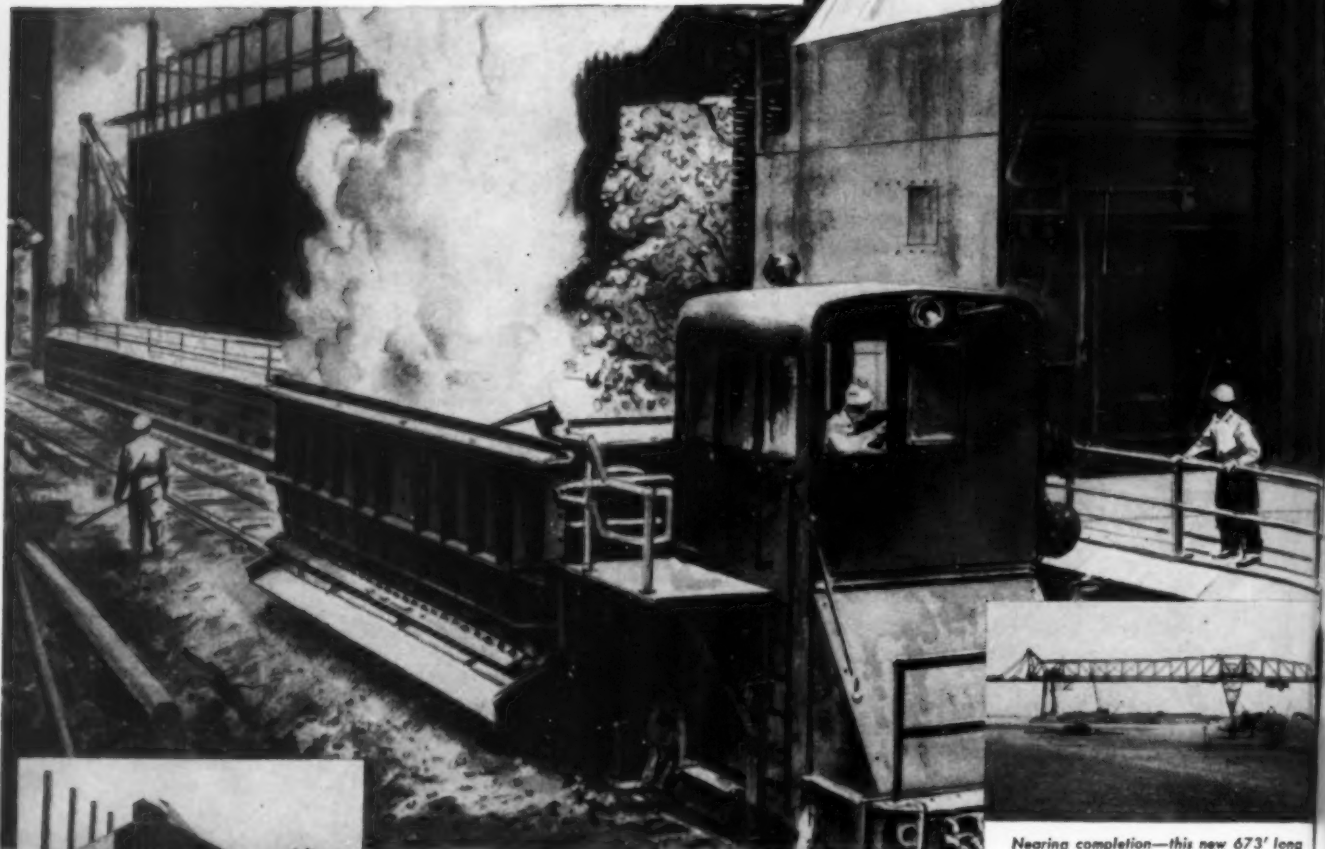
Berg has selected his regions mainly on the basis of the east-west vegetation belts. Controlled largely by climate, these belts are disrupted only in the southern and eastern parts by mountain areas. Since he is a keen observer of nature, the world of living things is the most important: the discussion of the natural vegetation and fauna is the nucleus of each chapter in the book. Endeavours to explain relief, and descriptions of climate, hydrography, soils, etc., are secondary. It was not the intention of the author to create a treatise on physical geography.

The chapters and paragraphs dealing with regions and sub-regions are not in proportion to the area, but rather to the amount of information available. Thus, the western and southern regions are treated in detail and the large but little-known eastern Siberia is discussed in six and one-half pages.

Berg describes each of his regions in a separate chapter. The northern tundra region takes in a larger area than usual, since one of its sub-regions—the wooded tundra—is considered a separate region by most authorities. His explanation of the origin of tundra landscape is important. The description of the forest region, which Berg subdivides into taiga and mixed forest, is excellent. Of interest to us is the applicability of the information about it to its Canadian counterpart. Unlike most authors, Berg places the deciduous forest and the forest steppe in one region. He does not consider the deciduous forest even a sub-region: it is a

(Continued on page X)

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(Continued from page VIII)

transition between forest and steppe. His discussion of the steppe region is complete. Next to the chapter on the forest region, that on the desert and semi-desert region is the best. Of interest is his belief that the sandy desert of Central Asia was caused by overgrazing, and the vegetation cover will return in time. In connection with this theory, he explains the sequence of the occupation of sands by vegetation. The chapter on the humid subtropics of Transcaucasia points up the sharp contrast between this area of rich vegetation and the desert. Each major mountain group is described as a separate region.

The photographs, representing mainly vegetation types, help in understanding the essential features of landscape. However, it is a pity that such a treatise as this has not a good map. Greatly oversimplified maps of the whole U.S.S.R. reduced to 6½ inches by 4 inches, on the scale 1 inch equals 900 miles, cannot be considered adequate. Many small but interesting areas mentioned in the text are not marked anywhere. It is unfortunate too, that sketches, profiles, maps of soils and hydrography—graphic material to supplement the text—are lacking.

Berg's approach to the studied problem is dynamic. He is not satisfied with the statement of existing relations, but tries to explain the origin of phenomena described. His somewhat unusual theories are valuable contributions to scientific study. For example, contrary to the opinion of most authorities, he does not think that loess is of aeolian origin, because many loess-like deposits show evidence of stratification by water.

Although there are mistakes and weak spots in the translation (some of the place names and terms are misinterpreted) it is on the whole successful. This combined achievement of the editors and the translator makes available to English-speaking readers a valuable scientific description of a country so like our own in its physical character.

B. ZABORSKI

* * *

Flowering Trees of the Caribbean

by Bernard and Harriet Pertchik

(Clarke, Irwin, Toronto, \$12.00)

Though perhaps of special interest to those who live in or have visited the Caribbean, this is a book which anybody might well covet for the beauty of its plates. It will appeal greatly to those who appreciate a meticulously painstaking realism, a realism which is not allowed to lessen the beauty of the plate as a whole.

The text, too, is pleasing in that it does not confine itself to a dry and technical discussion of the mere physical appearance of the trees illustrated but includes also much of the folk-lore and human side of their history and uses subjects usually ignored in botanical works though of great interest to the layman.

Good as the text is, it is the magnificent plates that will be remembered. Their detail is so fine as to suggest colour photography and the general effect is not unlike that in Audubon's birds. DOUGLAS LEECHMAN



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